



Narora Atomic Power Station (NAPS)

Field Trip Report

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Acknowledgements

The NAPS field trip and this subsequent drafting of the report was a really fruitful experience and the lessons learnt were truly invaluable. This trip genuinely made me feel a lot more interested in nuclear energy, it made me realise how crucial it is, how it truly is; the fuel of the future. I'm extremely grateful to all the people who helped me in this venture.

I'd like to thank my instructors and the support staff, who made our travel and facilitation at NAPS possible. They were with us there, at all times.

I would also like to thank my parents and friends who helped me with their valuable guidance and have been very supportive in various stages of this whole experience.

Why Nuclear Energy?

Electricity... the thing we all need. We need electricity for lights, fans, phones, laptops, televisions, air conditioners; for everything. It's really important for our survival.

Electricity is usually generated by running of 'turbines'. These turbines can be run by different methods, they can be driven by steam produced from fossil fuels combustion, from the kinetic energy of wind or flowing water, or from the heat released from nuclear reactions.

Fossil fuels are the oldest and the most widely used sources for energy production. Fossil fuels are made from decomposing plants and animals. These fuels are found in the Earth's crust and contain carbon and hydrogen, which can be burned for energy. Coal, oil, and natural gas are examples of fossil fuels. But the prolonged use of fossil fuels has a lot of disadvantages. Oxides emitted by fossil fuels, contribute to acid deposition, damaging the fertility of the soil including drinkable water. The combustion of coal, as well as petroleum, releases a large number of pollutants into the atmosphere, creating pollution levels. The combustion of fossil fuels also emits gases such as carbon dioxide, which contributes to climate change. Fossil fuels also, being non-renewable sources of energy cannot be readily replaced by natural means at a pace quick enough to keep up with consumption. So, we need replacements; they being renewable sources of energy.

Renewable resources are resources that can be replenished naturally over time. As a result, they are sustainable despite its consumption by humankind. They are much cleaner as well. Renewable sources of energy cause comparatively much lower levels of greenhouse gases, and emit no or very low air pollutants. Renewable energy is the most reliable form of energy and we can also say that it is the future of the world's energy needs.

Out of the different renewable sources of energy, nuclear power proves out to be one of the most efficient ways in the longer term. It is a really clean energy source causing very minimal pollution and provides a huge amount of energy output. It provides jobs as well, contributing billions annually to economies.

Nuclear Power in India

Nuclear power has emerged as an essential source of energy for many countries in the world. India is no exception to this trend. Nuclear power in India has become an increasingly important source of energy, with several nuclear reactors built across the country.

India's nuclear program began in the 1950s, and the country's first nuclear reactor, Apsara, was commissioned in 1956. Since then, India has made significant progress in nuclear technology. Nuclear power is currently the fifth-largest source of electricity in the country after coal, gas, hydroelectricity and wind power. There are now 22 nuclear reactors in operation across the country, with a total capacity of 6780MW.

One such nuclear power station producing nuclear power, is the topic of discussion today; the Narora Atomic Power Station.

Introduction to NAPS

60 kms from Bulandshahr in Narora, Uttar Pradesh lies one of the country's primary energy generating atomic station, the Narora Atomic Power Station, abbreviated as NAPS.



Commissioned in 1991, NAPS is operated by the Nuclear Power Corporation of India Limited (NPCIL). NAPS plays a crucial role in meeting India's increasing demand for electricity. The power station's performance has been commendable, with a high capacity factor of more than 90% in recent years. It has also been recognised for its excellent safety record and adherence to strict environmental standards. The plant houses two reactors, each a pressurised heavy-water reactor (PHWR) capable of producing 220 MW of electricity. Commercial operation of NAPS-1 began on 1 January 1991, NAPS-2 on 1 July 1992. The heat in the reactors is reduced using the primary coolant systems. The cooling resources are water from the Ganga river and Narora Barrage.

Narora Atomic Power Station has an advanced safety and environmental management system to ensure safe and efficient operations. The plant has implemented various measures to prevent any accidents or incidents. It has an emergency preparedness plan in place and conducts regular safety drills to prepare for any contingencies. The plant has a robust waste management system in place to ensure the safe disposal of nuclear waste. The radioactive waste is stored in specially designed containers and transported to a centralised waste management facility.

The Field Trip

The day of 1st April 2023 started, and it was full of enthusiasm and a lots of learning. We assembled together at 7:40 am and departed shortly after. Accelerating through Sikandrabad, Bulandshahr we arrive at Narora at around 11 am.

After de-boarding the bus, we went through a rigorous check by the CISF personnel where we were asked to leave our phones behind. Then we were shown a video made by NAPS which talked about nuclear energy, India's Nuclear Programme, and how operations took place at NAPS. It talked about the safety of NAPS and how there had been no incident in the recent times and that there is a vast ecology and healthy people all around NAPS.

Then we were taken to the Nuclear Energy Information Centre, where the process of nuclear power generation was clearly explained through a schematic flow diagram.

Nuclear applications in various fields were visually explained for a better understanding. Healthy discussions also took place which answered several questions and enlightened us all. Then we had a tasteful lunch, which was thoroughly enjoyed. Then visiting through a few more interiors led us inside the control room, the much awaited place for many where the devices that controlled the overall system were situated. Then after taking a closer look and observing the cooling towers and how they functioned, we got back to the bus and departed for the return.

A Study of the Process

NAPS houses PHWRs. A pressurized heavy-water reactor (PHWR) is a nuclear reactor that uses heavy water (deuterium oxide D₂O) as its coolant and neutron moderator. The heavy water coolant is kept under pressure, allowing it to be heated to higher temperatures without boiling, much as in a pressurized water reactor. The use of heavy water as moderator facilitates the use of natural uranium as the fuel.

The key to maintaining a nuclear reaction within a nuclear reactor is to use the neutrons released during fission to stimulate fission in other nuclei. With careful control over the geometry and reaction rates, this can lead to a self-sustaining chain reaction, a state known as ‘critical reaction’. To achieve critical reaction we need to slow down the fast moving electrons by absorbing their kinetic energy. This is achieved by using a moderator. At the same time, heavy water is used as a coolant to regulate the temperature of the reaction and generate steam.

Multiple systems and checks are put in to ensure safety at NAPS too. Proper procedures and codes are followed, stringent quality is assured, regular maintenance is ensured, only licensed and trained professionals are allowed to work. Narora is also surrounded by lush green forests and grassland cover which goes on to prove that the effect of radioactivity has been bare minimum in the vicinity of the Narora Atomic Power Station. The radioactivity has not at all affected people’s lives who live in the territory. Instead, they have been living healthy lives and have been bearing healthy and strong children, living absolutely normal lives.

Conclusions

This was overall a really beneficial experience. It proved out to be a very learning and educational trip, one which I'd certainly never forget.

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Thank You.